REMARKS

This case has been carefully reviewed and analyzed in view of the Official Action dated 8 May 2002. The undersigned attorney would like to take this opportunity to thank the Examiner for the courtesies extended during the personal Interview held on 13 June 2002. Responsive to the rejections made in the Official Action, and the discussions held at the Interview, Claims 1, 3, 14 and 15 have been amended and Claims 2 and 11 canceled by this Amendment.

In the Official Action, the Examiner objected to the drawings under 37 C.F.R. § 1.83(a). The Examiner stated that the drawings must show every feature of the invention specified in the Claims, and therefore, the primary element and the expanding area must be shown or the features canceled from the Claims.

A red-lined copy of the drawings of FIGS. 12A and 12C are enclosed for the Examiner's approval. It is proposed to add the delineation of the expanding area, reference numeral "23" thereto. The embodiment of FIG. 12 is a variation on the embodiment of FIG. 1, wherein a plurality of the loops of FIG. 1 are connected in parallel, as described in the Specification, page 11, beginning on line 15. FIG. 1 clearly shows the inclusion of the expanding area. Thus, no new matter is added by this proposed drawing change.

With respect to the "primary element", such feature has been canceled from the Claims. Thus, no drawing change is required with respect to the inclusion of the primary element.

In the Official Action, the Examiner rejected Claims 1-3, 5, 8-9, 11 and 14-15 under 35 U.S.C. § 112, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Examiner indicated a large number of terms which either lacked proper antecedent basis, or were indefinite and unclear and grammatically incorrect. Accordingly, Claims 1, 3, 14 and 15 have been amended to correct the language thereof. It is believed that the amended Claims now particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

In the Official Action, the Examiner rejected Claims 1-3, 9, 11 and 14-15 under 35 U.S.C. § 103, as being unpatentable over Okayasu, U.S. Patent #4,625,790, in view of Larson, et al., U.S. Patent #5,458,189. The Examiner stated that the Okayasu reference disclosed all of the claimed features of the invention with the exception of the loop being in a computer and the heat source being a CPU. The Examiner then stated that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have more than one loop, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. The Examiner then referred to the Larson, et al. reference as disclosing that it is well known to heat a looped heat pipe cooling a CPU within a computer for the purpose of compactly cooling an electronic device within a computer. The Examiner concludes that it would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ the heat pipe of Okayasu within a computer to cool a CPU as disclosed in Larson, et al.

Before discussing the references relied upon the Examiner, it is believed beneficial to first briefly review the structure of the invention of the subject Patent Application, as now claimed. The invention of the subject Patent Application is directed to a bubble cycling heat exchanger that includes at least one closed fluid loop having a liquid therein in thermal contact with a heat absorbing source through a heat conducting block. The loop has a bubble generator for generating bubbles in the liquid, and an externally mounted expanding area installed adjacent and in fluid communication with the loop. The loop is formed with a guide region from which bubbles are easily separable, and a radiator. Wherein, responsive to overheating of the heat absorbing source, the bubble generator generates bubbles and by an unequilibrium formed at the guide region of the loop, the bubbles separate from the guide region so that the liquid in the loop flows therethrough for transferring heat from the heat absorbing source to the radiator. The loop operates continuously until a thermal equilibrium is achieved.

In contradistinction, the Okayasu reference is directed to a heat transport apparatus that comprises a closed loop including a heating block and a radiator having a pulsatile fluid flow. The heating block is provided with a recess for producing a small bubble that is grown by heating the heating block. The bubble grows by virtue of the temperature of the heating block exceeding the saturation temperature of the working fluid vapor and the internal pressure in the bubble seed. The working fluid evaporates towards the bubble at the interface between the working fluid and the bubble, causing the bubble to grow. The

increase in the size of the bubble causes a corresponding increase in pressure in the pipes G_1 and G_2. Responsive to the pressure change, the check valve CV_1 and the check valve CV_2 opens. The continually growing bubble causes the working fluid to flow past the valve CV_2 into the accumulator H. The surface area of the bubble increases as it grows on the side of the pipe G_2, but growth of the bubble stops when the amount of evaporation of the working fluid at the heating block becomes identical with the amount of condensation of vapor on the increased surface area of the bubble. As the bubble grew, the working fluid was displaced from the pipe G_2 into the accumulator H, the increased volume of the fluid causing the flexible bellows of the accumulator to expand outwardly.

With the bubble growth stopped, the amount of condensation of vapor comes to exceed the amount of evaporation, and the bubble thus begins to contract. Under these conditions, the pressure in the bubble becomes less than that in the accumulator and the check valve CV_2 closes, while the check valve CV_1 opens. Along with this change in the check valves, the bellows constricts to cause the working fluid to flow from the accumulator through the pipe M_1, the radiator EX, the pipe M_2, and the check valve CV_1 into pipe G_1, and forcing the working fluid into the heating block B. The heating block B is thus cooled by the working fluid flowing thereinto, to further constrict the bubble and cause a negative pressure with which the working fluid is drawn from the accumulator through the radiator and through the heating block. This flow of cooled working fluid causes the bubble to momentarily disappear, allowing the cycle to be repeated, Column 2, Line 61 - Column 3,

Line 53.

Thus, the flow of working fluid within Okayasu is pulsatile, with the bellows of the accumulator being utilized to pump the working fluid from the accumulator during one portion of the cycle. The accumulator is in line with the flow path and by virtue of its expanded volume increases the flow resistance to the working fluid, as do the check valves CV_1 and CV_2.

Whereas in the invention of the subject Patent Application, the bubble generator continuously generates a plurality of bubbles which are guided within the guide region to flow through the loop. The expanded vapor which forms the bubbles is collected in that expanding area that is located external and adjacent to the fluid loop and in fluid communication with the fluid loop. In the reference system, however, the bubble never leaves the area between the two check valves.

The Larson, et al. reference does not overcome the deficiencies of Okayasu. The Larson, et al. reference is directed to a two phase component cooler for cooling electronic devices. However, nowhere does the reference disclose or suggest the inclusion of an expanding area that is externally mounted and adjacent to the fluid loop, and in fluid communication therewith, as now claimed.

Therefore, the combination of Okayasu and Larson, et al. cannot make obvious the invention of the subject Patent Application, as now claimed. The other references relied upon by the Examiner for combination with Okayasu and Larson, et al. to make obvious

other features of the invention of the subject Patent Application, do not overcome the deficiencies of Okayasu, et al. Thus, in combination those references cannot make obvious the invention of the subject Patent Application, as now claimed. Further, the Claims dependent on the amended Claim 1, are believed to be dependent upon an allowable base Claim, and therefore allowable for at least the same reasons.

It is now believed that the subject Patent Application has been placed in condition for allowance, and such action is respectfully requested.

Respectfully submitted,
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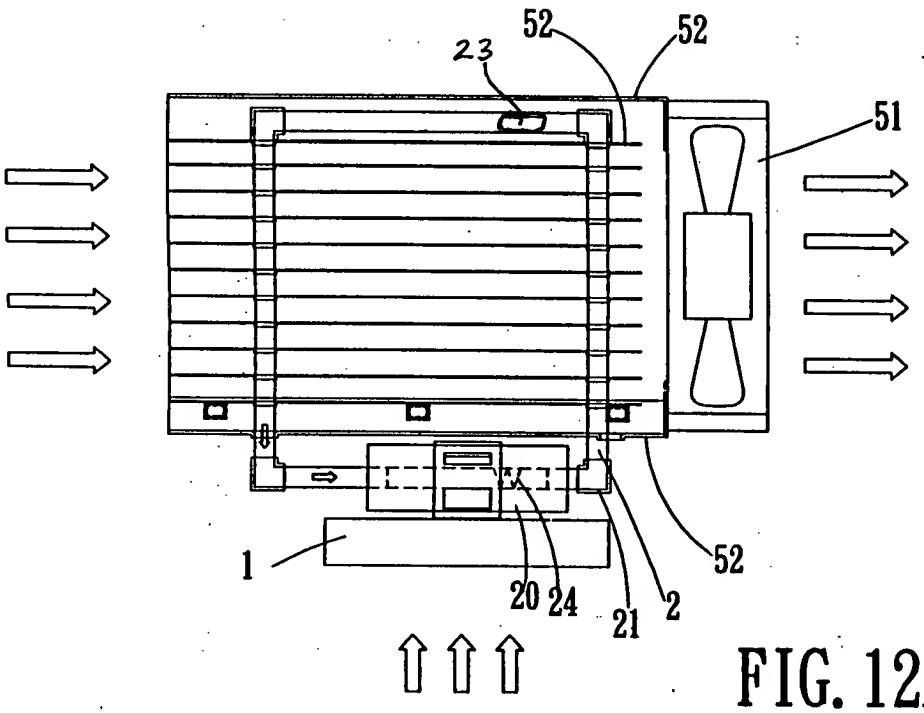

FIG. 12A

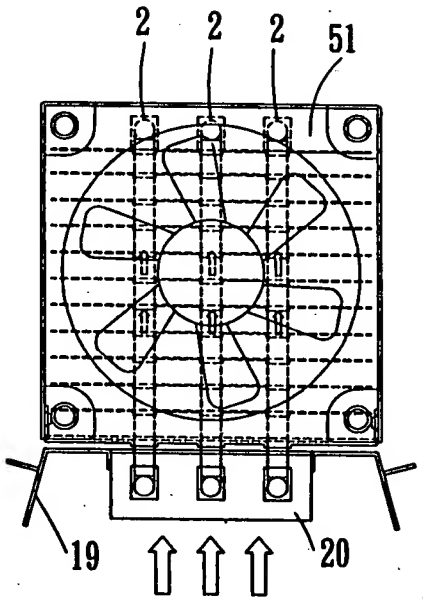

FIG. 12B

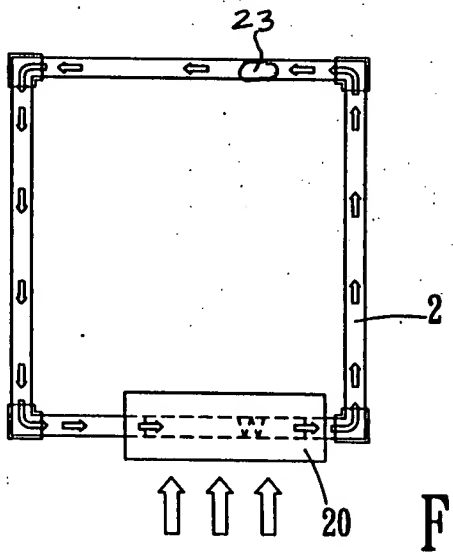

FIG. 12C

MARKED-UP VERSION OF AMENDED CLAIMS

1. (Amended) A bubble cycling heat exchanger, [wherein a] comprising at least one closed fluid loop having a liquid therein and being [is] in thermal contact with a heat absorbing source through a heat conducting block; the loop [has] having a bubble generator for generating bubbles in the liquid, and an externally mounted expanding area [for generating bubbles is] installed adjacent and in fluid communication with the [at] loop; the loop [is also] being formed with a guide region from which bubbles [is] are easily separable and a radiator; [a heat conducting block of the closed loop is connected to a heat absorbing source; since the] wherein responsive to overheating of the heat absorbing source, [will cause] the bubble generator [loop to] generates bubbles and [;] by an unequilibrium formed at the guide region of the loop, the bubbles [will] separate from the [heat absorbing source] guide region so that the liquid in the loop flows therethrough for transferring heat [so that heat is radiated by the fins or other elements of the radiator] from the [primary element of a computer at the] heat absorbing source to the radiator, the loop [operates] operating continuously until a [heat] thermal equilibrium is achieved.

3. (Amended) The bubble cycling heat exchanger as claimed in claim [2] 1, wherein the loop [at the heat conducting block on the central processing unit] is installed with [at least one] a fin set.

14. (Amended) The bubble cycling heat exchanger as claimed in claim 1, [wherein at least one loop is formed] further comprising a plurality of closed fluid loops disposed in parallel and in thermal contact with the heat absorbing source.

15. (Amended) The bubble cycling heat exchanger as claimed in claim 14, wherein the plurality of loops are symmetric [at the] with respect to left and right sides of the heat absorbing source.